

Project 1 - Part 2

Zhicheng Zhang - G45149856

1. Introduction

Compare the PISA and Alpha ISA by executing the same benchmarks on the two configurations.

2. Implementation

Prepare

Environment

- Docker image [krlmlr/debian-ssh](https://hub.docker.com/r/krlmlr/debian-ssh) on Debian 10 (host).
- File `~/singlesim-3v0e.tgz` is downloaded from <http://www.singlescalar.com/>.
- File `~/benchmarks.tar.gz` is downloaded from <http://www.ecs.umass.edu/ece/koren/architecture/Singlescalar/benchmarks.tar.gz>.

Script

```
# install
apt-get install tar build-essential

# unzip
tar zxvf singlesim-3v0e.tgz
tar zxvf benchmarks.tar.gz

# path
PATH=$PATH:~/singlesim-3.0
```

ALPHA: Compile & Run

```
# compile
cd ~/singlesim-3.0
make clean
make config-alpha
make
make sim-tests
```

```
cd ~

# run
cd ~/simplesim-3.0/tests/bin
sim-profile -iclass test-math
sim-profile -iclass test-fmath
sim-profile -iclass test-llong
sim-profile -iclass test-printf
cd ~
```

PISA: Compile & Run

```
# compile
cd ~/simplesim-3.0
make clean
make config-alpha
make
make sim-tests
cd ~

# run
cd ~/simplesim-3.0/tests/bin.little
sim-profile -iclass test-math
sim-profile -iclass test-fmath
sim-profile -iclass test-llong
sim-profile -iclass test-printf
cd ~
```

3. Result

ALPHA

```
1. root@61fec0de913c: ~/benchmarks (ssh)

load          6491559  25.36
store         2541971   9.93
uncond branch 1142226   4.46
cond branch   2636107  10.30
int computation 11423148 44.63
fp computation 1360117   5.31
trap          2306     0.01
sim_inst_class_prof.end_dist

ld_text_base    0x0120000000 # program text (code) segment base
ld_text_size    106496 # program text (code) size in bytes
ld_data_base    0x0140000000 # program initialized data segment base
ld_data_size    71264 # program init'ed '.data' and uninit'ed '.bss' size in bytes
ld_stack_base   0x011ff9b000 # program stack segment base (highest address in stack)
ld_stack_size   16384 # program initial stack size
ld_prog_entry   0x01200059c0 # program entry point (initial PC)
ld_environ_base 0x011ff97000 # program environment base address address
ld_target_big_endian 0 # target executable endian-ness, non-zero if big endian
mem.page_count  54 # total number of pages allocated
mem.page_mem    432k # total size of memory pages allocated
mem.ptab_misses 454174 # total first level page table misses
mem.ptab_accesses 69952303 # total page table accesses
mem.ptab_miss_rate 0.0065 # first level page table miss rate

root@61fec0de913c:~/benchmarks#
```

PISA

```
1. root@61fec0de913c: ~/simplesim-3.0/tests/bin (ssh)

load          8439  17.13
store         5147  10.45
uncond branch 1946   3.95
cond branch   5424  11.01
int computation 27304 55.42
fp computation  928   1.88
trap           79   0.16
sim_inst_class_prof.end_dist

ld_text_base    0x0120000000 # program text (code) segment base
ld_text_size    188416 # program text (code) size in bytes
ld_data_base    0x0140000000 # program initialized data segment base
ld_data_size    41984 # program init'ed '.data' and uninit'ed '.bss' size in bytes
ld_stack_base   0x011ff9b000 # program stack segment base (highest address in stack)
ld_stack_size   16384 # program initial stack size
ld_prog_entry   0x012000f750 # program entry point (initial PC)
ld_environ_base 0x011ff97000 # program environment base address address
ld_target_big_endian 0 # target executable endian-ness, non-zero if big endian
mem.page_count  28 # total number of pages allocated
mem.page_mem    224k # total size of memory pages allocated
mem.ptab_misses 74 # total first level page table misses
mem.ptab_accesses 530706 # total page table accesses
mem.ptab_miss_rate 0.0001 # first level page table miss rate

root@61fec0de913c:~/simplesim-3.0/tests/bin#
```

4. Conclusion

ALPHA

| ALPHA Benchmark | Total # of Instructions | Load % | Store % | Uncond Branch % | Cond Branch % | Integer Computation % | Floating pt Computation % |
|-----------------|-------------------------|--------|---------|-----------------|---------------|-----------------------|---------------------------|
| test-math | 49268 | 17.13 | 10.45 | 3.95 | 11.01 | 55.42 | 1.88 |
| test-fmath | 19357 | 17.61 | 12.61 | 4.73 | 11.12 | 53.34 | 0.43 |
| test-llong | 10485 | 17.60 | 14.79 | 5.49 | 12.12 | 49.69 | 0.10 |
| test-printf | 983331 | 17.99 | 10.74 | 4.82 | 11.39 | 54.85 | 0.09 |

PISA

| PISA Benchmark | Total # of Instructions | Load % | Store % | Uncond Branch % | Cond Branch % | Integer Computation % | Floating pt Computation % |
|----------------|-------------------------|--------|---------|-----------------|---------------|-----------------------|---------------------------|
| test-math | 213553 | 15.96 | 10.67 | 4.22 | 13.84 | 54.42 | 0.88 |
| test-fmath | 53312 | 16.17 | 14.47 | 4.24 | 15.08 | 49.90 | 0.11 |
| test-llong | 29495 | 16.38 | 18.11 | 4.37 | 15.40 | 45.70 | 0.00 |
| test-printf | 1813745 | 19.22 | 9.28 | 5.13 | 17.01 | 49.33 | 0.01 |

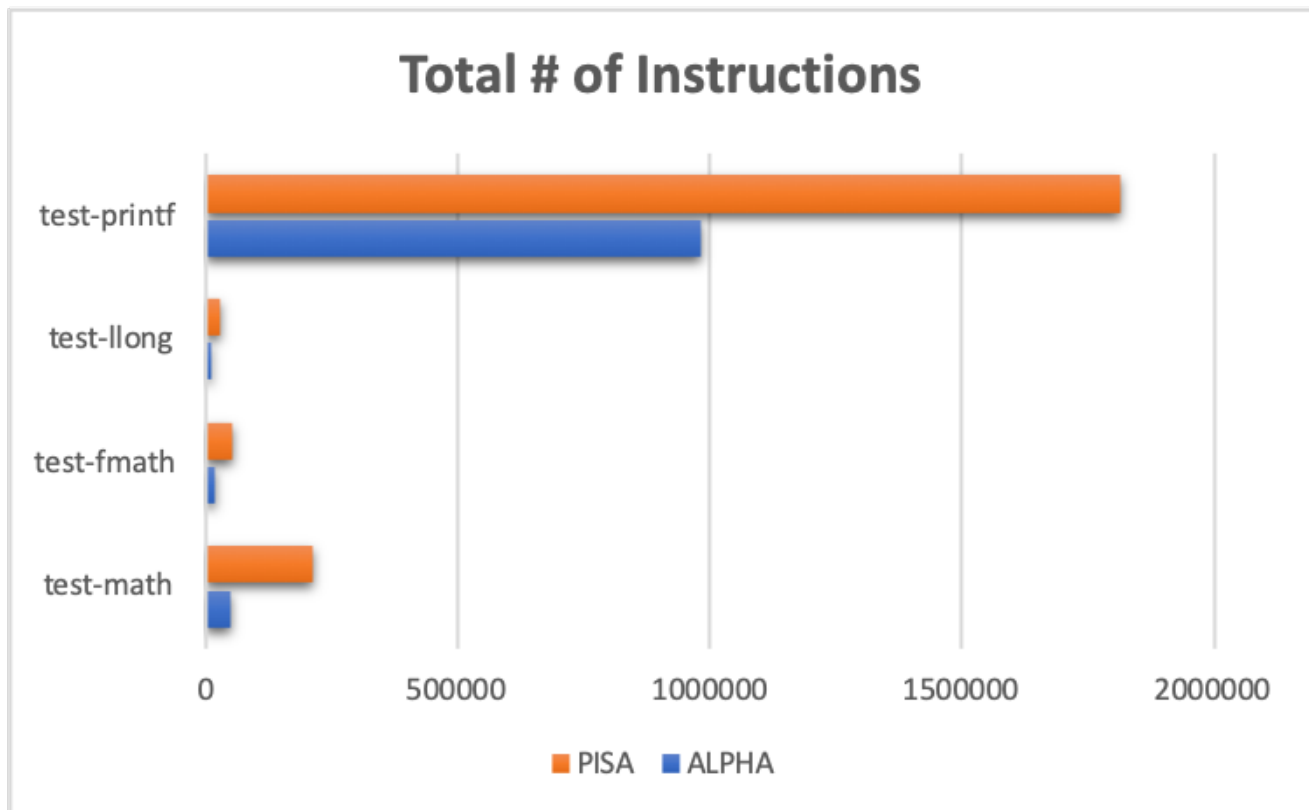
5. Discussion

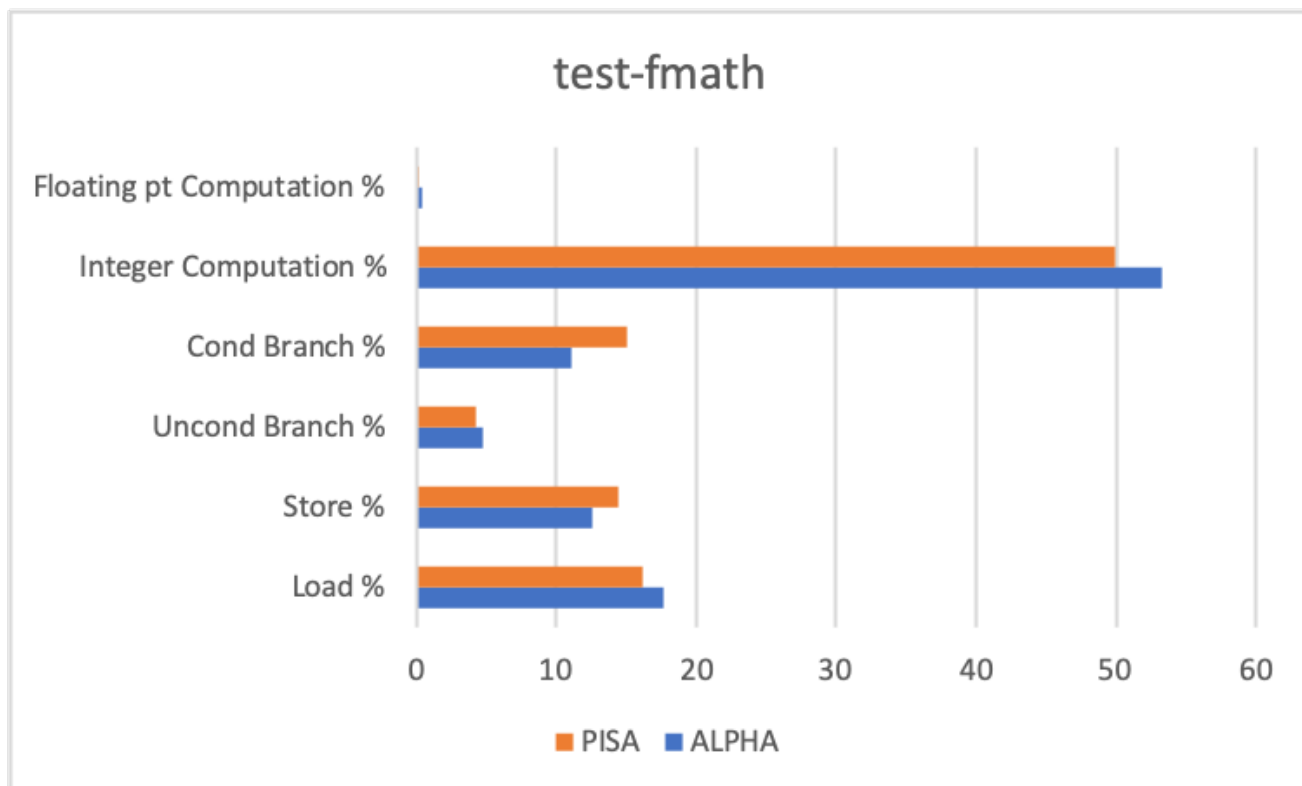
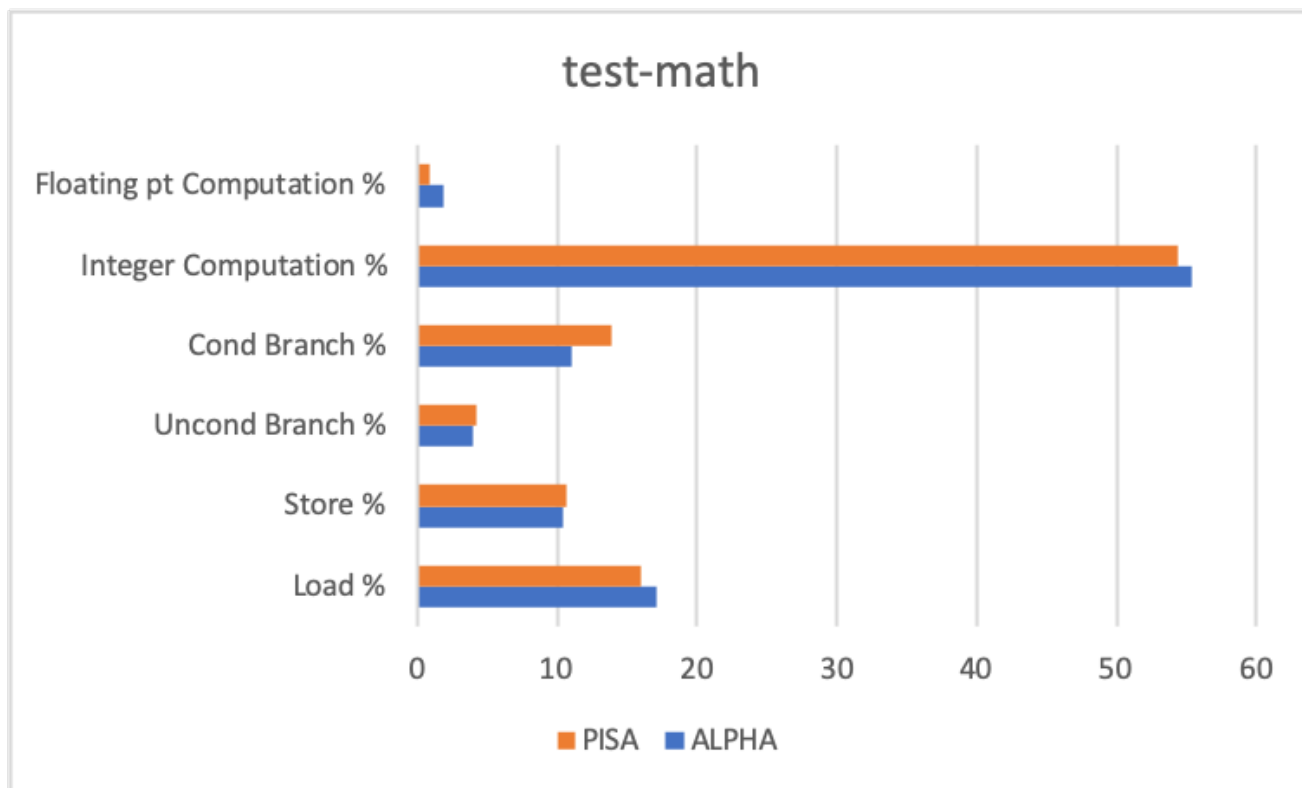
Now compare the two ISAs using a plot (a Histogram is preferred). Use MATLAB or EXCEL to plot the histogram.

What can you conclude about the two ISAs from the Histogram.

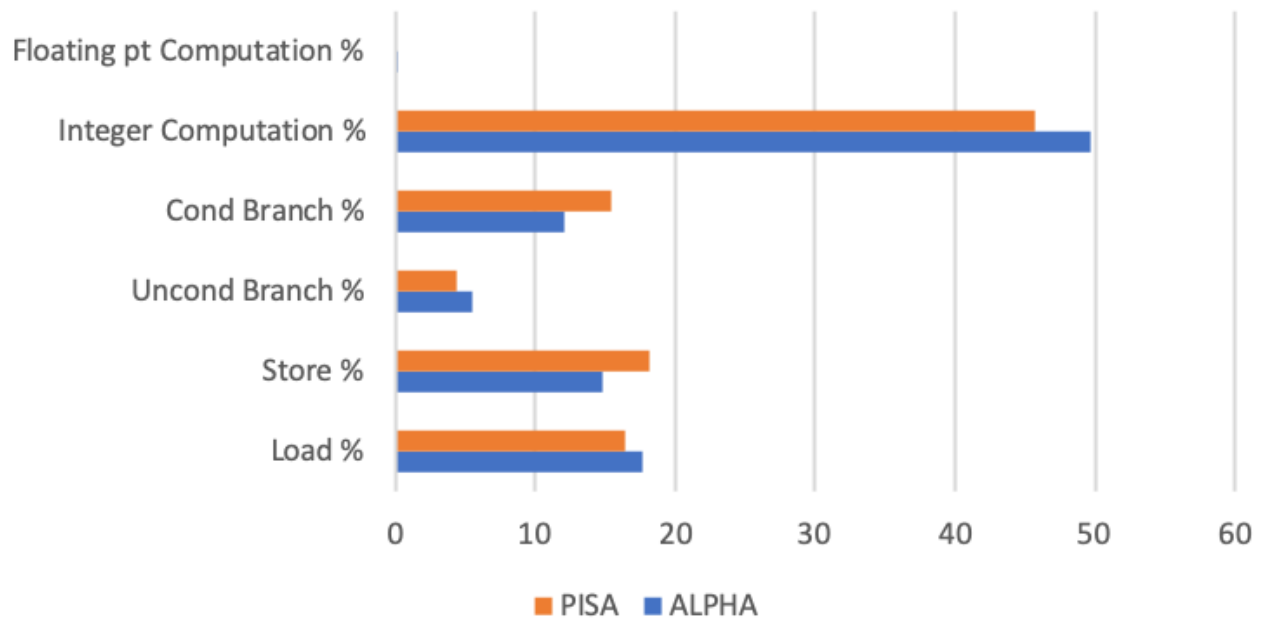
It seems that "Total # of Instructions" of PISA is far more than which of ALPHA.

However, proportions of instruction types between PISA and ALPHA have little difference.





test-llong



test-printf

